Do Immigrants Displace Native Workers? Evidence from Matched Panel Data

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Abstract

Using rich matched employer-employee panel data, we analyse the impact of immigrants on natives' employment. Unlike most of the existing literature, we draw on matched data and focus at the firm, occupation and worker levels, which enables us to link the labour market outcomes of natives and immigrants precisely at the locus where many popular beliefs are formed. This paper, therefore, provides a novel test of complementarity and substitutability between the natives and immigrants. Our main result shows that, contrary to previous evidence, natives at even the lower end of the skills spectrum have their employment *positively* affected by the presence of immigrants in the same firm and occupation. The results highlight the importance of suitable data to properly assess the impact of migration on host country's labour market.

Keywords: matched data, recruitment policy, immigrants, employment, Portugal
JEL codes: J15, J61

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* We would like to thank Gianluca Orefice, two anonymous referees, the Editor, Sushanta Mallick, as well as conference participants at the International workshop on "Economics of Global Interactions", University of Bari, for comments on an earlier version. José Varejão acknowledges funding for this work by FCT under Grant PTDC/EGE-ECO/120020/2010). CEF.UP is funded by FCT's 'Programa Compete'.

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1. Introduction

The impact of immigration on a receiving country's economy, particularly its labour market, is a hotly debated topic. Although there is no consensus in the existing literature about the overall effect on natives' employment, there is still plenty of empirical evidence that shows that immigrants have a modest effect on the employment (and wages) of natives. Notwithstanding this evidence, the popular perception, including among some policymakers, is that immigrants 'steal' natives' jobs: for instance, many argue that when firms hire immigrants, they may be displacing or at least reducing the hiring of native workers. One reason why the difference between empirical evidence and people's perception might persist, as pointed out by Malchow-Moller *et al* (2009), is that most of the empirical literature uses relatively aggregated data, i.e., considering changes in labour supply only at the regional level, to analyse the role of migrants on host country's labour markets. However, the debate in public opinion and social media about immigrants taking natives' jobs is probably based more at the interactions that occur at the firm level, as in the example mentioned above. This is another reason why it is important to analyse the overall impact using data at the firm and worker levels, as we do in this paper, to properly address the (true and perceived) impacts of immigrants on natives' labour market outcomes.

Within the general structure in the existing literature, two opposing results have been obtained depending on the stated assumptions. For instance, Borjas (2003) uses US census data to analyse the labour market effects of large immigration flows in the 1980s and 1990s, assuming that similarly educated immigrants and natives have different work experiences and therefore are not perfect substitutes. In contrast to some previous literature (e.g. Card, 1990, Altonji and Card, 1991, and, more recently, Clemens and Hunt, 2017), Borjas (2003) and subsequent papers find a negative impact of immigration on the labour supply (and wages) of competing native workers. Card (2001) also uses 1990 US census data to study the impact of immigrant flows on natives' occupation-specific labour market outcomes in selected US cities. He treats natives and immigrants as a heterogeneous group as well, though similarly educated immigrants and natives are assumed perfect substitutes, and finds only a small negative effect on the employment prospects (and wages) of low-skilled workers in certain US gateway cities like Miami and Los Angeles.

Similar modest effects of immigration have also been obtained for a number of European countries. Pischke and Velling (1997) use German county level data to analyse the employment effects of immigration on local labour markets. They study two measures of immigration: the

change in the share of foreigners between 1985 and 1989 and one year gross and net flows of immigrants to an area. Using different model specifications, they show that there is little evidence for displacement effects of natives in the counties' labour markets due to immigration. Carrington and De Lima (1996) analyse the labour market impacts of *retornados,* refugees from Mozambique and Angola to Portugal from 1974 to 1976, many of which were natives to Portugal. They compared the Portuguese case with developments in France and Spain that were affected by similar shocks but did not experience a massive inflow of immigrants. In addition, they also made comparisons at the county level within Portugal. Their cross-country comparison results suggest that immigration had a "very modest" effect on the labour market in Portugal though the within-country comparison shows that immigrants diminish natives' labour market opportunities. However, the authors state that they "find the international comparisons more persuasive" and that their "overall results are consistent with the earlier literature: immigration does not have a large adverse effect on natives' labour market outcomes".[1] Notwithstanding this conclusion, in a recent reappraisal of the same mass influx episode, Mäkelä (2017), using a synthetic control approach, concluded that the influx had a significant adverse effect on labour market outcomes in line with the standard textbook model.

Borjas (2006), however, argues that a number of these papers assess the "spatial correlations" model where the effect on natives within a locality/state is estimated. These models, according to him, assume away the setup within which a large immigrant flow in one region might mean an outflow of natives from that region to another. His analysis shows that once this native outflow is taken into account from one US state to another, the results could reveal more clearly the real impact of immigration: in this setup the natives move out of the region where immigration rates are higher, hence creating possible negative effects on natives. While his main focus is on the wages of natives, his overall results could be used to show that there is a clear implication for natives when their response to immigration supply shock is taken

[1] Similar results are obtained by Winter-Ebmer and Zimmerman (1999) for Germany, Winter-Ebmer and Zweimuller (1999) for Austria, Villosio and Venturini (2006) for Italy, Carrasco *et al* (2004) for Spain and Dustmann *et al* (2004) for the UK. However, Brucker et al (2011), using a different approach than the others, showed that immigrants have a negative effect on the internal mobility of natives in Italy. They argued that this could potentially have detrimental effect on natives who move from low employment to high employment regions. Finally, Latif (2015) showed that immigrants increase the overall unemployment rate in the Canadian provinces in the short but this effect disappears as immigrants acquire local job experience and/or host country specific human capital.

into account. One clear aspect of his paper, as well as a few others (e.g., Borjas *et al*, 2008), is the diverging results obtained once assumptions of a model are changed, even when using the same type of data.

Notwithstanding the extensive literature on the topic, it is clear that there is still no consensus on how immigrants affect the labour market for natives. This is partly because all of the papers discussed above assess net migration implications based on immigration flows at a regional level, primarily because of a lack of consistent disaggregated data, which means that the existing results possibly underestimate the impact of migration as they are not able to capture the true incidence either at the firm level or at each skill/occupation level. Borjas (2003; p.1370) acknowledges this inadequacy in the existing literature by stating: "I suspect that we can learn a great deal more about the labour market impact of immigration by documenting the many adjustments that take place, by workers and firms, both inside and outside the labour market, as immigration alters economic opportunities in many sectors of the economy".

Our main objective in this paper, therefore, is to contribute to the existing literature by using firm- and worker-level data as that has far more potential to capture certain key aspects of the impact of immigrants on the employment opportunities of natives than the census or other regional data. More precisely, we want to analyse whether natives and immigrants are substitutes or complements at the firm, occupation and worker levels. To our knowledge the only other paper that addresses this issue at such a disaggregated level is Malchow-Moller *et. al.* (2009). They use firm-level matched employer-employee data from Denmark and employ a competing risks duration model distinguishing between job-to-job and job-to-unemployment transitions to analyse the impact of immigration on native employment.[2] They find no evidence of immigrants displacing or "taking the jobs" of natives in Denmark. While our focus is similar to theirs, we use a different empirical approach and a different matched data set. We argue that by using matched employer-employee data we will be able to go beyond existing studies and bring the literature on the labour market effects of immigration closer to topics of interest to employment relations research, by examining how employers shape personnel policies when they can choose between the two types (native and immigrant) of workers.

In order to carry out the analysis we use the *Quadros de Pessoal*, which is a matched panel data set collected annually by the Portuguese Ministry of Employment for all employees

[2] Malchow-Moller *et al* (2012) use the same Danish data to study the effects of immigration on natives' wages.

in all (private) enterprises. The data set contains company-based information, socio-demographic characteristics of the employees, employment conditions and other relevant information about workers and private firms. Using different model specifications, we show that the natives and immigrants are 'complements' at most occupation levels, in the sense that they are jointly hired and fired. More precisely, we find that in the expansionary phase of the firm, the hiring strategy is not one of displacing natives with immigrants (for cost or other purposes) but rather the two groups are complementary in terms of new hiring by firms. Controlling for different skill-level groups as well as for temporary/permanent nature of the jobs, the estimates show that, contrary to the evidence from some existing literature, even at the lower end of the skills spectrum, natives are not affected by migration.

In conclusion, our paper sheds light on the important topic of whether immigrants have a detrimental effect on host country's labour markets, at the firm and occupation levels, and finds evidence inconsistent with the sometimes popular view that immigrants steal natives' jobs. A key advantage of working at the worker or within-firm level is that we are measuring the relation between the employment of natives and non-natives precisely at the locus where many popular beliefs are formed; however, even in this case we do not find evidence of negative correlations. The results obtained have therefore implications for not only immigration policy in Europe but other migrant-receiving countries as well.

The rest of the paper is organised as follows. The next section presents the estimation strategy used in this paper while a brief description of Portugal's immigration record as well as data and descriptive statistics are presented in Section 3. Section 4 discusses the results. Concluding remarks appear in the last section.

2. Analytical/Empirical Framework

A standard approach to analyse the labour market effects of immigration is to use the competitive labour demand/supply model and determine the impact on equilibrium of a change in labour supply, with either treating natives and immigrants as homogenous in terms of their skill levels or treating them as having distinct skill levels. This strand of literature is based on the "spatial correlations" model (see Borjas, 1999) which primarily uses the flow of immigrants within a geographic location and estimates the effect on wages and employment from the resulting rightward shift of the labour supply curve.

Since this empirical methodology in the existing literature considers the net employment implication only at either the regional or industry level, it is unlikely to properly capture the impact of immigrants on native employment levels. An advantage we have over the existing literature is the availability of detailed disaggregated employer-employee matched data, which enables us to estimate a model that can take into account the changes at the worker- and firm-level. Hence the key contribution of this paper is that, rather than looking at the aggregate migration stock or flow at the regional or national level, it analyses the decision process at the firm and job levels. We believe that exploring the impact at the disaggregated level is important to understand whether immigrants really displace native workers.

We use the following equation to estimate the level of displacement, if any, of the native workers.

$$n_{it} - n_{it-1} = \alpha(f_{it} - f_{it-1}) + \beta x_{it} + a_i + \varepsilon_{it}, \quad (1)$$

where the left-hand side captures the change in employment of natives (as a result of firm's hiring or firing) and the first expression on the right-hand side is the analogous change for immigrants (or non-natives), again at the same firm and time period; x_{it} denotes other characteristics that influence the employment of natives, excluding wages, such as the business cycle; and a_i denotes a firm fixed effect.[3] Note that no distinction is made regarding the skill level of natives and immigrants here. Therefore, if the change in the employment in natives is positively correlated with the change in immigrants' employment, then we can conclude that natives and foreigners are hired and fired jointly. If, however, the correlation is negative, even after controlling for business cycle effects, then we can conclude that natives and immigrants are substitutes in the sense that when the firm-level count of immigrant workers increases, the natives count decreases (immigrants displace natives), and vice-versa.

[3] Wages are excluded due to endogeneity concerns. We considered different ways of controlling for the price of labor, including the wage differential between natives and immigrants. However, we believe that these alternative regressors would not be immune to the same endogeneity concerns. All things considered, our preferred specification does not include an independent variable that controls for absolute or relative wages of native workers. Hence, we are estimating conditional correlations between changes in employment of natives and migrants without making any claims of causality.

The above model assumes that natives and immigrants are homogeneous in terms of their skill level with the underlying assumption that all labour enters the firm's production function as a single input. However, as pointed out by some of the existing literature, labour should be split into at least two components, skilled and unskilled. Since there is some evidence that immigrants tend to be low skilled, the argument is that an increase in the supply of low skilled labour will decrease the relative supply of skilled labour thus pushing up their wages. This causes relative wages for the low skilled to fall resulting, potentially, at least in the short-run, in a disequilibrium in the labour market due to unemployment of natives. The result can then be interpreted as a negative effect of immigration on a particular native labour group. We can capture this more directly within our model, by estimating eq (1) again but now at different job levels.

Finally, one feature of Portuguese labour market in the last few years is an increase in the level of temporary employment (e.g. fixed term contracts) compared to permanent (open-ended) employment. As argued in the literature (and supported in Table 1, described below), immigrants may have a bigger impact on jobs that are temporary in nature.[4] In order to capture this aspect, we also estimate the impact on temporary and permanent employment. We again estimate eq. (2) but this time distinguishing between the two types of contracts. All versions of equation (2) are estimated by pooled OLS as well as (firm) fixed-effects.

3. Background and Data Description

From an historical perspective, Portugal had been a country of emigration, except for a short period of time during 1975/76 when there was a huge inflow of immigrants from its former colonies in Africa. However, the trend started to change around 1993 when outflows started to decrease and return migration from the rest of Europe accelerated, with the inflows further increasing in 2000 and especially after 2005 following EU Eastern enlargement and a construction boom driven by low interest rates. In this process, the proliferation of Eastern European immigrant communities, especially from Ukraine, first became apparent.

The rapid increase in the number of foreign citizens residing in Portugal since the turn of the century is for the most part due to a high number of immigrants admitted on temporary

[4] Table 1 shows that 20.7 percent of all native employed workers are on fixed-term contracts. For immigrants, the corresponding percentage is 49.2.

permits, most of which were later converted to permanent status. [5] Due to a combination of visa conversions and return flows, the stock of immigrants on temporary permits declined significantly between 2005 and 2007. However, it was not until 2010, at least partly due to a significant increase in unemployment, that the number of immigrants in Portugal declined for the first time.

The immigration flow to Portugal over the last 30 years also implied major changes in the composition of the stock of non-natives residing in the country, especially in terms of their national origins (Eastern Europe, but also Asia), that are not confined any longer to individuals originating in the Portuguese former colonies in Africa. Immigrants from Brazil and Ukraine became amongst the largest foreign communities in the country, and Romanians are the largest group originating within the European Union. Still, immigrants to Portugal remain younger and, on average, less educated than natives. Their wages are about 20 percent below those of natives, the wage differential being attributed to occupational downgrading, absence of match-specific human capital and selection into low-pay sector of the economy (Carneiro et al, 2012).

The impact of the significant flows of migration on the Portuguese labour market could be captured by using a detailed panel data set that the Ministry of Employment collects annually -- the *Quadros de Pessoal* (QP). As it is required by law for all firms to provide the relevant information about their employees, and the questionnaire is also available to all workers, the data set is a very reliable source of matched employer-employee information. From the employers' side, we have information about the type of business and industry, number of employees in each firm and the wages paid; while from the employees' side we know their gender, age, education, country of origin, type of contracts (permanent or temporary), tenure, job title, wages and hours of work.[6]

The data that we use have been used before in the context of migration studies by Carneiro et al (2012), Hijzen et al (2013), and Cabral and Duarte (2014, 2016). To the best of our knowledge, our article is the first to use these data to study the impact of migration flows on the employment of natives. All the other papers using the same data study the wage

5 Part of the growth of the stock of foreign citizens residing in the country between the years 2001 and 2003 is due to a legislative change after which immigrants who had entered the country irregularly became eligible for temporary residential visas.

6 See Carneiro et al (2012), Hijzen et al (2013) and Snell et al (2018) for other articles that also use this data set.

differentials between immigrants and natives (or the related question of wage differences between domestic and foreign firms) or differences in wage rigidity between the two groups.

The first wave of the data set was collected in 1982 though the information on workers' nationality was not included until 2000. However, because the 2001 worker file is not available, the data used in this paper covers the time period 2002 to 2008 (the last wave before the global financial crisis which had a significant negative impact on Portuguese labour market). Our analysis covers a seven year period of mild economic growth and rising unemployment – the unemployment rate was at 5.0 percent in 2002 and 7.6 percent in 2008. For that reason, we are confident that our results are not shaped by the choice of the period. Notwithstanding this, where appropriate, we split the data in two subgroups of firms – those with increasing and decreasing number of (foreign) employees. The analysis starts at the worker level but, for the sake of comparison with previous studies, it also considers data at different levels of aggregation. A separate data set was constructed for each level of analysis. All data sets are derived from the original worker files.

Tracking workers across data waves is essential for our purpose as separations can only be identified comparing the situation of the same worker in two adjacent waves. This is possible because each worker is assigned a unique time-invariant identification number the first time he or she enters employment in the private sector. Hence, all cases of workers with invalid identification numbers (about 40,000 per year) were deleted. Newly-admitted workers are all workers that are employed by firm j in year t but were not employed by the same firm in year $t-1$. Because this condition cannot be implemented in the first wave, admissions in 2002 were identified on the basis of self-reported date of admission. Separations were identified using a similar procedure: we consider that one separation occurs in year t if the worker is employed by firm j in year t but not in year $t+1$. Separations cannot be identified in the last data wave (2008).

All waves from 2002 to 2008 were pooled together without any further modification of the data. Because lagged values of some variables are used in regression analysis and the 2008 wave cannot be used due to the absence of data on separations for this year, worker-level results were derived from data for the period 2003-2007. The final dataset has 11.2 million observations, an average of 1.9 million observations (workers) per year.

Over this period, in the final sample, the share of non-native workers in total employment increased from 4.5 percent in 2003 to 5.0 percent in 2007, which is in line with the growth trend also observed in the official statistics of the stock of non-native population residing in

the country. In total, the data include 10.7 million observations on natives and 0.5 million observations on non-natives. The corresponding descriptive statistics are reported in Table 1.

Because the data we use were obtained from an annual census of employers and employees in the private sector of the economy, the descriptive statistics mirror very closely the characteristics of employment in the Portuguese labour market, except in terms of age and schooling.[7] Workers are predominantly male (56.4 percent), and they have low levels of education (67.4 percent with nine years of schooling or less). On average, 19.1 percent of all workers are in an employment spell with a total elapsed duration of 12 months or less; 22.1 percent of all workers are on a fixed-term contract.

As compared to natives, non-native workers display specific characteristics: the share of men is significantly larger (64.4 percent versus 56.0 percent in the case of natives) and they are younger (the average age is 35.3 years and 36.4 for natives). Despite similar levels of schooling, non-natives are more frequently assigned to lower-rank jobs: 26.9 and 6.2 percent of non-natives are hired as non-skilled professionals and apprentices/interns, respectively (10.7 and 4.8 percent in the case of natives). More significantly, 49.2 percent of all non-native (20.7 percent of all native) workers are hired on a temporary (fixed-term) contract. Tenure profiles are also biased towards shorter durations in the case of non-native workers - for 73.3 percent of them (38.1 percent of natives), tenure on the job is shorter than three years.

Data at the worker level was also used to produce four additional data sets, each corresponding to a different level of aggregation, which was implemented at the industry/region level (7,000 observations), firm level (1.7 million observations), firm/job title level (3.5 million observations and 444,669 observations), and also at firm/contract type level (444,300 observations). In order to guarantee that each unit considered has sufficient room to substitute workers across narrowly defined cells, at the two latter levels two additional restrictions were imposed on the data: firms are required to be present in at least four waves of the data and to have a minimum number of 10 employees at least in one wave.

[7] In the empirical part of the paper, all the estimations based on worker-level data were obtained considering only workers below the age of 55. Given the correlation between age and schooling, the latter variable is also biased upwards. The descriptive statistics reported in Table 1 correspond to the exact same data used in the empirical work, *i.e.*, after excluding observations on workers aged 55 or more and observations corresponding to workers employed by firms that shutdown in the corresponding year.

4. Empirical Results

We first report results of the estimation of Eq. (1) with firm level and within-firm level versions of our data. Results obtained with aggregate data, i.e., at the industry-region level, are also reported, for comparison with previous research. All of these results are presented in Table 2.

The estimates displayed in the first column of Panel A indicate that there is a positive, albeit insignificant, correlation between the employment changes of natives and immigrants at the level of the firm. This result indicates that, for employers, the two groups are certainly not substitutes. Stronger (and statistically significant) evidence of complementarity is found if we consider more homogeneous groups of workers inside the firm as we do when we repeat the analysis at the firm-job title level – Panel B. At this level, the result indicates that a one unit change in the number of immigrant workers at the firm, is accompanied by a variation in the same direction of 1,353 in the number of native workers in the same position in the same firm. Complementarity is also found at the industry-region level – Panel C. At all the different levels considered, our results imply more positive immigration effects on natives' employment opportunities than previous studies. But our results also indicate that at higher levels of disaggregation, such as industries within regions, job titles within firms or firms, the (positive) correlation between the employment of natives and immigrats is stronger.

Yet we should note that this result is entirely driven by the subset of firms with increasing number of non-native workers (column 2). For these firms and regardless of the level of analysis, immigrants and natives are complements – the corresponding estimate is always positive and significant, including at the firm level. As for the overall sample, the magnitude of the relationship is strongest at the aggregate level when the sample is restricted to units with increasing non-native employment.

For the other subset of firms – those with decreasing number of foreign workers (column 3), the correlation between the variation of natives and non-natives' employment is not significantly different from zero. However, we do note that, for the firm level, the corresponding estimate is negative. It is beyond the scope of this article to explain the reasons why this is the case. However, with the caveat that the negative correlation is not significant, one possible reading of our results is that in firms going through downsizing processes non—native workers are laid-off first and/or that non-native workers occupy positions that are more likely to disappear.

As we mentioned before, equation (1) only holds if the two groups of immigrants and natives are perfect substitutes. However, the existing literature argues that substitutability is more likely to hold for narrowly defined groups of workers with similar skills (Borjas *et al*, 2008). Hence, we re-estimated the same model as in panel B of Table 2 *per* job title, i.e., taking the firm-level change in the number of natives in each job category as the dependent variable and controlling for changes in the number of immigrants in every group also at the firm-level. Results are presented in Table 3 where the diagonal measures the association between contemporaneous changes in the firm-level count of natives and immigrants in similar jobs. Starting with column 2 and row 1, we see that all estimates are positive (and significantly different from zero), indicating that the firm-level headcount of immigrants and natives in similar jobs move together in the same direction. For instance, it is 2,065 in the case of skilled professionals, the largest job title.

Consistent with the previous results, these estimates imply that, even for narrowly defined jobs, employers do not substitute natives with immigrants. On the contrary, immigrants and natives are jointly hired and fired. This is true for all types of jobs considered, including lower skilled jobs. Therefore, contrary to the evidence in the existing literature of some small negative impact on lower skilled native workers, our results show that when using matched employer-employee longitudinal data, there is actually a strong positive association of immigrants on native hiring when matching the two groups at each skill level within firms. Moreover, virtually all cross-job effects are not significant at conventional levels. Taken together, these results imply that when hiring (or firing) for specific positions, employers consider immigrants and natives as complements. The only exception to this otherwise general result refers to when firms change the number of foreign skilled professionals. In this case, we find a significant and negative correlation between the firm-level employment of that category of foreign workers and the number of native non-skilled professionals and native trainees. This is consistent with the result that Carneiro et al (2012) also obtained for Portugal that point at immigrants being assigned to lower levels of jobs than similar natives working for similar employers. Occupational downgrading of immigrants may lead to substitutability of non-skilled natives for more highly-skilled non-natives, which is what we observe.

It has been argued in the literature that immigrants, compared to natives, might be more willing to take the jobs that are temporary in nature and/or in which there is no prospect of upward occupational mobility, perhaps because they entered the country on short-term visas. In this case, migrants would be more likely to compete with the natives in those more flexible

type of contracts (see Fernández and Ortega, 2008, and Somerville and Sumption, 2009). To see if this is the case, we also estimated eq. (1) separately for temporary and permanent employment. The results, presented in Table 4, indicate that immigrants and natives are jointly hired (fired) in both types of positions considered, permanent or temporary. Moreover, the positive correlation between the change in the number of natives and immigrants in temporary positions is even stronger than it is in the case of permanent positions. Cross-effects between temporary and permanent positions are again not statistically significant, meaning that employers do not replace permanent native workers with temporary non-native workers.

5. Conclusion

There is a vast literature that has studied the impact of immigration on natives' employment in the host country. All of the existing studies, with only one pair of exception to our knowledge (Malchow-Moller et al, 2009, 2012), use aggregate data. Possibly because of the inherent limitations of aggregate data, the results obtained across the existing literature are not consistent. These inconsistent results have obvious negative implications in terms of the policy debate. We contribute to the literature by using a particularly rich longitudinal matched employer-employee census. The key aspect of our novel data and empirical approach is that it allows us to analyse the impact of immigration at the level where it is likely to be most pronounced and directly visible and also where it attracts greater public opinion attention, i.e., at the firm- and job-level. We also study the case of a country, Portugal, which experienced a large inflow of immigrants over a relatively short period of time while proposing a methodology that could be replicated and extended with further analysis for other countries.

In our findings, we analyse whether two types of workers, immigrants and natives, tend to be hired and laid-off jointly or, alternatively, if one group of workers tends to replace the other. The results show that, at the level of the firm, hirings and separations of immigrants and natives are significantly positively correlated. In other words, we find no evidence, even at this very detailed level of analysis, that natives lose their jobs because of immigrants – employers do not replace native workers with immigrants. We also found that, when making hiring decisions, firms do not differentiate between immigrants and natives, which is especially the case at the occupation level. Finally, we also found that the complementarity between natives and immigrants holds even when we distinguished hiring under temporary and permanent contracts.

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Table 1. Descriptive statistics: worker-level data (2003-2007)

	All	Natives	Non-natives
Native	0.953		
Non-native	0.047		
Separation rate		0.179	0.389
Male	0.564	0.560	0.644
Worker age	36.348	36.398	35.335
Tenure			
≤12 months	0.191	0.179	0.416
12-36 months	0.207	0.202	0.317
>36 months	0.602	0.619	0.267
Skill-level			
Top manager	0.094	0.097	0.043
Intermediary/middle manager	0.045	0.047	0.020
Supervisors/Team leaders	0.036	0.037	0.014
Higher-skilled professionals	0.068	0.070	0.025
Skilled professionals	0.393	0.396	0.344
Semi-skilled professionals	0.156	0.156	0.151
Non-skilled professionals	0.115	0.107	0.269
Apprentices/Interns	0.049	0.048	0.062
Schooling			
≤4 years	0.013	0.011	0.052
4-9 years	0.661	0.665	0.576
12 years	0.207	0.207	0.188
College	0.112	0.114	0.069
Fixed-term contract	0.221	0.207	0.492
Temporary Help Agency	0.021	0.018	0.085
Part-time	0.030	0.029	0.051
State-owned firm	0.032	0.033	0.007
Multinational firm	0.099	0.099	0.084
Multiplant firm	0.346	0.348	0.300
Firm age (years)	20.795	21.063	15.375
N	11,213,763	10,684,884	528,884

Note: the test of the equality of the means across the two sub-groups – natives and non-natives - leads in all cases to the rejection of the null with a significance level of 1 percent.

Table 2: Effect of immigrant employment on native employment (2003-08)

Dependent variable: Change in natives' employment at the corresponding observation level

		All Firms	Firms with *increasing* number of foreign workers	Firms with *decreasing* number of foreign workers
A. Firm-level	Change in immigrants' employment level	0.354 (0.388)	1.356* (0.596)	-0.139 (0.339)
	R-squared	0.017	0.072	0.069
	N	1,695,795	84,508	79,064
B. Firm-Job Title level	Change in immigrants' employment level	1.353*** (0.363)	1.831** (0.647)	0.528 (0.668)
	R-squared	0.217	0.594	0.654
	N	3,482,811	87,677	77,849
C. Industry-Region level	Change in immigrants' employment level	2.072*** (0.245)	2.077*** (0.591)	1.057 (1.141)
	R-squared	0.425	0.570	0.003
	N	6,987	2,590	1,949

Notes: All results in Panel A were obtained from fixed-effects (FE) estimation on firm-level data. Firm-cluster robust standard errors in parentheses. All results in Panel B were obtained from pooled OLS regression on firm-job title pairs data, with unit of observation level fixed effects. The unit of observation in this data set is the job title within the firm. Year, industry and region dummies are included in the regressor set. Firm-job title cluster robust standard errors in parentheses. All results in Panel C were obtained from FE regression on industry*region level data, with fixed effects defined at the same level as the unit of observation (industry×region fixed-effects). Industry-region cluster robust standard errors in parentheses. * $p<0.05$, ** $p<0.01$, *** $p<0.001$. Firms that do not employ foreign workers ares excluded from the samples used to produce the results in the two last columns.

Table 3: Effect of immigrant employment on native employment, by job title (firm-level analysis) - Pooled OLS with Firm Effects Estimates (2003-08); Dependent variable: Change in natives' employment level, total and by job title

	Change in native employment								
	All natives in a firm	CEO/High Managers	Middle managers	Supervisor/team leaders	Higher-skilled Professionals	Skilled Professionals	Semi-skilled Professionals	Non-skilled Professionals	Apprentices/Trainees
Change in Immigrant's Employment by job title									
CEO/High Managers	4.979* (2.552)	**3.376*** ** (0.929)	0.564 (0.639)	0.221 (0.239)	-0.993 (1.043)	-0.647 (0.875)	1.274 (0.883)	0.243 (0.221)	0.020 (0.046)
Middle managers	3.746 (2.795)	0.542 (0.588)	**1.400*** (0.687)	-0.024 (0.073)	-0.899 (1.056)	0.596 (1.374)	1.105 (0.566)	0.707* (0.293)	0.061 (0.036)
Supervisor/team leaders	1.912** (0.640)	-0.028 (0.027)	0.056 (0.068)	**1.143*** (0.502)	-0.086 (0.186)	0.660 (0.798)	-0.066 (0.258)	0.125 (0.127)	0.016 (0.061)
Higher-skilled Professionals	0.916 (2.560)	-0.425 (0.378)	-0.307 (0.392)	0.090 (0.195)	**5.514*** (2.283)	-0.338 (1.682)	-0.751 (1.267)	-0.779 (0.559)	0.099 (0.184)
Skilled professionals	1.096 (0.581)	-0.053* (0.023)	0.126 (0.105)	0.040 (0.039)	0.142 (0.096)	**2.065*** ** (0.609)	-0.215 (0.125)	-0.394* (0.180)	-0.043* (0.020)
Semi-skilled Professionals	-0.473 (1.285)	0.008 (0.021)	0.017 (0.041)	-0.019 (0.040)	-0.0003 (0.049)	-0.149 (0.307)	**1.538** (0.895)	-0.094 (0.126)	0.007 (0.023)
Non-skilled Professionals	1.595** (0.512)	0.018* (0.008)	-0.033 (0.029)	0.028 (0.023)	-0.069 (0.062)	-0.278 (0.253)	0.093 (0.112)	**1.699*** ** (0.326)	0.033 (0.020)
Apprentices/Trainees	0.193 (0.788)	-0.003 (0.036)	-0.045 (0.046)	-0.015 (0.071)	-0.250 (0.259)	-0.912 (0.892)	0.701 (0.678)	0.120 (0.296)	**1.704*** ** (0.472)
Constant	-3.189 (3.345)	0.052 (0.340)	-0.351 (0.243)	-0.273 (0.219)	-0.272 (0.303)	0.831 (1.209)	-0.499 (0.670)	-0.876 (0.633)	0.001 (0.310)
R-squared	0.291	0.179	0.176	0.176	0.160	0.226	0.177	0.294	0.146
N	444,669	444,669	444,669	444,669	444,669	444,669	444,669	444,669	444,669

Notes: All results were obtained from pooled OLS regression on firm-level data, with firm fixed effects. The unit of observation in this data set is the firm. Firm fixed effects as well as year, industry and region dummies are included in the regressor set. The sample covers all firms present in at least four waves of the data and employing a minimum number of 10 employees at least in one wave. Firm cluster robust standard errors in parentheses; * p<0.05, ** p<0.01, *** p<0.001. Main diagonal coefficients in bold.

Table 4: Effect of immigrant employment on native employment, by job-contract - Pooled OLS Estimates with Firm Effects (2003-08)

Dependent variable: Change in natives' permanent employment level (column 1) and Change in native's temporary employment level (column 2)

	Permanent Employment	Temporary Employment
Change in Immigrant's Permanent Employment	1.939***	0.050
	(0.504)	(0.134)
Change in Immigrant's Temporary Employment	0.155	2.910***
	(0.100)	(0.735)
2004	0.196	0.235**
	(0.127)	(0.082)
2005	-0.120	0.217
	(0.167)	(0.121)
2006	-1.281***	-0.089
	(0.137)	(0.108)
2007	-1.322***	0.376**
	(0.136)	(0.123)
2008	-1.501***	-0.256*
	(0.128)	(0.091)
Constant	0.745	-1.890
	(2.165)	(1.875)
R-squared	0.233	0.327
N	444,291	444,291

Notes: All results were obtained from pooled OLS regression on firm-level data, with firm effects. The unit of observation in this data set is the firm. Firm effects as well as industry and region dummies are included in the regressor set.
Sample used here covers all firms present in at least four waves of the data and employing a minimum number of 10 employees at least in one wave.
Firm - cluster robust standard errors in parentheses; * $p<0.05$, ** $p<0.01$, *** $p<0.001$.